REMARKS

I. INTRODUCTION

Applicant and Applicant's undersigned attorney wish to thank Examiners Rosenberger and Barth for the courtesy of the personal interview on December 6, 2002 as confirmed in the Interview Summary (Paper No. 7). As indicated in Paper No. 7, the *Milnes* and *Fishman* references were discussed; however, no agreement was reached.

Claims 1, 14 and 19 have been amended, and new claims 20-22 have been added. Accordingly, claims 1-22 are presently pending in this application. Reexamination and reconsideration is hereby respectfully requested.

II. OBJECTION TO THE DRAWINGS

Applicant has submitted under separate cover an amendment to Figure 1. Applicant respectfully submits that no new matter has been introduced by the amendment, and that the amendment is effective to overcome the objection. Approval of the drawing amendment is hereby respectfully requested.

III. AMENDMENT TO THE SPECIFICATION

The Table 1 on page 6 of the originally submitted specification has been amended to delete the wavelength "596" corresponding to the row in the table at 1600° C and insert the wavelength "496". No new matter has been entered, since this amendment merely conforms the specification to the drawings (Figure 2) and claims as originally submitted, as permitted.

IV. CLAIM REJECTION UNDER 35 U.S.C. § 102

Claims 1, 17 and 18 stand rejected under 35 USC 102(b) as being anticipated by *Milnes* (US 3,187,185). Applicant respectfully overcomes this rejection.

Independent claim 1 recites "said object having a characteristic, temperature-dependent, self-emitted EMR spectrum." Claim 1 recites that the "reflected component of said projected EMR has a wavelength different than said self-emitted, dominant EMR spectrum." For at least the reasons set forth below, Applicant respectfully submits that *Milnes* does not teach these recitations.

Temperature of the Object. The main objective of *Milnes* is to achieve (1) "rapid handling" and (2) "non-contact" for the "surface contour and/or thickness" of the target

object. (Col. 1, Lines 9-15; Col. 1, Lines 19-24). It is therefore not surprising that temperature is never a factor in *Milnes*' invention. *Milnes* never specifies a temperature or a temperature range of the "workpiece P"—the steel bar. Without a recognition for and an appreciation of temperature as a factor that shapes the self-emitted EMR envelope of wavelengths of a hot object, Applicant respectfully contends that the disclosure of *Milnes* does not reasonably teach a hot object having "a characteristic, temperature-dependent, self-emitted EMR spectrum". *Milnes* does not recognize temperature-dependent, self-emitted EMR or its problems, much less disclose or suggest any solutions. The Office relies on the mention in *Milnes* of the term "red-hot" to support the contention that *Milnes* teaches a system dealing with hot objects having self-emitted, dominant EMR. In this regard, the Office has stated:

> *Milnes* further disclose (iv) that the system may project a different wavelength EMR upon the object than the object's self-emitted wavelength (col. 1, lines. 65-69). The example provided therein is that when the sample is glowing red-hot (i.e., self-emitting in the red spectrum of visible light), a blue or ultra-violet beam may be incident upon it, such that the self-emitting EMR is distinguishable. . . . In this context, the "dominant" self-emitting radiation in *Milnes* is red, and such is clearly temperature dependant, since the metal will emit differently at different temperatures.

Applicant respectfully disagrees.

There are indicia in the *Milnes* patent to support the contention that the reference to "red hot" is simply a layman's reference to "hot". First, in *Milnes*, the background (*i.e.*, table 2 upon which the workpiece P rests) for the steel bar being inspected needs to be colored in a contrasting color relative to the projected beam color. This cannot be accomplished if the steel bar (workpiece P) is "red hot" meaning hot enough to have self-emitted EMR. The Examiner's attention is drawn to *Milnes* at column 1, lines 66-71:

> The color of the beam of light 6 is selected so that it contrasts with the color of the workpiece P. For example, if the workpiece P is red-hot steel, a blue or ultraviolet beam is preferred. The color of the surface of the table 2 is selected to contrast with the color of the beam 6.

While this requirement in *Milnes* is possible to implement when a workpiece is simply colored in red but otherwise not "red hot" as that term is generally used, Applicant respectfully submits that this is not possible for applications with a workpiece with a self-emitted, temperature-dependent RED color due to the very high temperature involved. Up to

today, there is no such paint or coloring scheme[1] with arbitrarily selectable color that can withstand the contact of a self-emitting "red-hot" workpiece (800° C or hotter). Therefore, Applicant does not believe that the term "red-hot" in *Milnes* can reasonably be interpreted to mean "glowing" red hot (*i.e.*, "dominant self-emitting radiation") as contended by the Office. This "red" could be either a paint or other color added onto the workpiece and the "hot" is a temperature such as, for example, 100C, or simply a loosely used lay term meaning "hot".

Second, *Milnes* further disclose "means for filtering out all frequencies of light other than the ultraviolet energy situated between the images and the said measuring means". However, self-emitted EMR from a truly "red hot" piece of steel could include ultraviolet energy in some cases. Therefore, the *Milnes* reference is more consistent with a red colored piece of steel (where the above quoted "means for filtering' could be more effective), or just a "hot" piece of steel having a temperature less than that required for self-emitted EMR. This passage is less consistent or inconsistent with an interpretation where "red hot" means glowing (self-emitted EMR) red hot, where in such a case, the "means for filtering" would not address the problem of self-emitted EMR obstructing the view of such a hot object because it would not filter out all the self-emitted EMR.

Third, while *Milnes* describes an application in a steel rolling mill, not all metal in steel rolling mills is hotter than 800° C (at which temperature steel starts to radiate on its own visible light). The Office had stated that "such as high-temperature metals in metal foundries, wherein the object or metal is at such temperatures that it will have a self-emitted EMR, described therein as "red-hot steel. (co. 1, ln 69)." Office Action at page 3. There are more cold rolling mills, whose working temperature is no higher than 500° C than hot rolling mills. One cannot infer from the context of a steel rolling mill alone that the workpiece described therein is hot enough to have self-emitted EMR.

In sum, Applicant respectfully submits that the Office has placed undue emphasis on the wording "red hot" in *Milnes* as teaching a hot object having "a characteristic, temperature-dependent, self-emitted EMR spectrum" as claimed.

Color does not equal Wavelength. Even assuming for purposes of argument only that the term "red-hot" means that the steel bar in *Milnes* is hot enough to have self-emitted EMR,

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[1] Based on the knowledge in the steel and forging industry. The inventor is currently working with MACSTEEL (Jackson, MI), Timken Steel (Canton, OH), Inland Steel (East Chicago, IL), Charter Steel (Saukville, WI) and the American Iron and Steel Institute (Washington D.C.) in search of a painting technology that can survive the self-emitted "red-hot" (hotter than 900C) condition.

the claimed approach of distinguishing projected EMR from self-emitted EMR based on wavelength is novel and non-obvious compared to the approach disclosed in *Milnes* of using color contrast. Color contrast cannot meet the limitation that the "reflected component of said projected EMR has a wavelength different than said self-emitted, dominant EMR spectrum" as positively claimed.

Color is "the aspect of things that is caused by differing qualities of the light reflected or emitted by them." "It may be defined in terms of the observer (sense A) or of the light (sense B): A. The appearance of objects or light sources described in terms of the individual's perception of them, involving hue, lightness, and saturation for objects and hue, brightness, and saturation for light sources. B. The characteristics of light by which the individual is made aware of objects or light sources through the receptors of the eye, described in terms of dominant wavelength, luminance and purity."[2]

This definition teaches that color does not equal wavelength. There are other factors such as intensity (brightness or luminance) and purity that define color. "Different in color" cannot be directly translated to "different in wavelength." Also, color is an interpretation by eyes, not an absolute measurement. One wavelength can yield different colors and one color can contain many different wavelengths. For instance, a 550-nm radiation at a moderate intensity appears green to a normal human eye. A 550-nm radiation at a strong intensity appears WHITE to a human eye. Such phenomenon is documented in the model of color solid. Also, both 620-nm radiation and 680-nm radiation appear to be RED to most human eyes.

The word "contrast" reflects the fact of "difference." Any two objects that are different in a certain perspective are considered "contrasting" each other. Based on this, "color contrast" means "difference in color." This "color contrast" notion as taught by *Milnes* is distinctly different to the approach of the present invention, which is based on wavelengths separation.

Color is a perception of human eyes, as a result of stimulus given to the eyes by the radiation at certain wavelengths. It does not have a measurable means of defining a color and it has a very limited spectrum range (from 400 nm to 700 nm). Accordingly, it is respectfully submitted that mere mention of a "color contrast" in *Milnes* does not anticipate the specific recitations of distinct wavelengths of projected EMR versus self-emitted EMR.

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[2] The American Heritage Dictionary.

Color Contrast Can Fail. The teaching of using "contrast color" does not solve all the problems addressed by the present invention. *Milnes* uses the phrase "red-hot" in the example. This phrase is merely a loosely defined perception of *Milnes*. No specific temperature and or size of the hot object is attached to this description. A hot object (incandescent radiation) can have many different appearances. The "color" of a hot object can vary in accordance with the temperature and/or the size of the object. If "red-hot" is interpreted as an object the self-emitted radiation, then the phrase "red-hot" may cover a much broader spectrum of wavelength contents than simply "RED."

That is, a "red-hot" object can indeed appear "**white-hot**," if the size is large (intensity of radiation is proportional to the solid angle created from the projection of the area of a hot object onto the receptors of the eye). This is an important point, because two different, hot objects of the same material and temperature will have substantially the same self-emitted EMR envelope, but may appear either "red" or "white" based on size differences. Of course, the "white hot" object may in fact be "hotter" (the hotter the object, the "whiter" the color), but this example illustrates how the notion of color contrast in *Milnes* is not the same as wavelength separation as positively claimed in the present invention. In sum, "color" is a collective perception of dominant wavelength, luminance and purity. If the wavelength and purity are held same, a stronger intensity (luminance) could yield a different color.

While blue or ultraviolet (as a color) contrasts "red," it may not contrast "white," the kind of white resulting from either higher temperature or stronger intensity (larger size), or both. Either blue or ultraviolet (as a color) can not be separated from the self-emitted "white" radiation.

Furthermore, the color contrast approach disclosed in *Milnes*' cannot work for a "white-hot" object. Based on *Milnes*' teaching, a light beam with a contrast color should be used to illuminate the "white-hot" object. What is the "contrast color" of "white"? It is commonly known that "**black**" contrasts "white." Therefore, *Milnes* would suggest using "**black**" light to illuminate a "white-hot" object. This however can not be practiced in real life. Again, as noted above, "color" does not equal to "wavelength." At most, *Milnes* teaches distinguishing "red-hot" color of the workpiece P from the projected beam of light based on color, not wavelength.

For example, the specification of the present invention, as originally submitted, disclose that using "wavelength separation" to distinguish the externally projected and self-

emitted radiation can mean "using RED color to contrast RED color." Table 1 on page 6 of the present application provides the "longest usable wavelength," as derived from the radiation equations stated on pages 7 and 8. Table 1 is also plotted on FIG. 2. Consider an object at 800° C or cooler. Such object, according to the "IRON-CARBON/CEMENTITE PHASE DIAGRAM," published by ASM International and attached hereto as Exhibit B, is radiating a dark red (at the borderline of visible light). The present invention disclosed in Table 1 that "any wavelength that is shorter than 700 nm, say 625 nm, can be used" (longest usable is 700 nm). That is, the present invention teaches that an externally projected visible light radiation can be used to contrast the self-emitted radiation from an object at this temperature. In the present invention, BOTH the self-emitted EMR and the projected EMR are RED in color, which is clearly not taught by *Milnes*. Note that the object is in RED and the illumination can be in RED (625 nm). This is clearly not taught by *Milnes*.

No Definition from Milnes. There is no qualification given by *Milnes* as to (a) what kind of contrast, and (b) how strong of contrast are needed for *Milnes*' invention to work. One may question its enablement.

In sum, Applicant respectfully requests the Office to reconsider its position as reproduced here: that the dominant "self-emitting radiation in *Milnes* is red, and such is clearly temperature dependent, since the metal will emit differently at different temperatures." (Office Action at page 3, lines 14-16). *Milnes* does not disclose that the self-emitted EMR is temperature dependent. While one can conclude after reading Applicant's specification that many materials such as steel, ceramics, etc. have this characteristic as a physical property, this is not the same as the *Milnes* reference disclosing this feature. Without a recognition of this physical property, *Milnes* cannot be said to teach the concept of selecting the projected illumination (the wavelength(s) thereof) as a function of temperature and material of the hot object, as now positively claimed. For at least these reasons, Applicant respectfully submits that the rejection based on *Milnes* has been overcome.

Claims 2-18 depend from independent claim 1, and therefore contain all of the limitations thereof. Accordingly, for at least the same reasons set forth above in connection with Applicant's response to the rejection of claim 1, claims 2-18 are also believed allowable.

V. CLAIM REJECTION UNDER 35 U.S.C. § 103

Claims 2-10, 15 and 16 stand rejected under 35 USC 103(a) as being unpatentable over *Milnes*, in view of general principals and practices in the art. Applicant respectfully overcomes this rejection.

Claims 2-10, 15 and 16 depend from independent claim 1 and therefore contain all of the limitations thereof. Accordingly, for at least the same reasons set forth above in connection with Applicant's response to the rejection of claim 1, Applicant respectfully submits that the rejection of claims 2-10, 15 and 16 has been overcome.

VI. CLAIM REJECTION UNDER 35 U.S.C. § 103

Claims 11-13, and 19 stand rejected under 35 USC 103(a) as being unpatentable over *Milnes* in view of King (US 5,995,008), further in view of the general principals and practices in the art. Applicant respectfully overcomes this rejection.

Claims 11-13 depend from independent claim 1, and therefore contain all of the limitations thereof. Independent claim 19 has been amended along the lines of the amendment to claim 1. Accordingly, for at least the same reasons set forth above in connection Applicant's response to the rejection of claim 1, Applicant respectfully submits that the rejection of claims 11-13 and 19 has been overcome.

VII. CLAIM REJECTION UNDER 35 U.S.C. § 103

Claim 14 stands rejected under 35 USC 103(a) as being unpatentable over *Milnes* in view of *Fishman* (US 4,744,407). Applicant respectfully overcomes this rejection.

As an initial matter, claim 14 depends from independent claim 1, and therefore includes all of the limitations thereof. Therefore, for at least the same reasons provided above in Applicant's response to the rejection of claim 1, Applicant respectfully submits that the rejection of claim 14 has been overcome. Applicant, however, also contends that claim 14 recite additional subject matter no taught in the art, as described more fully below, and for this additional reason contend claim 14 is allowable.

Claim 14, as amended, recites an airflow controller to provide "air at a preselected temperature to reduce a temperature gradient to remove air density distortion." Neither *Milnes* nor *Fishman* disclose this recitation.

The office action states on page 13, lines 7-10 that:

> The Specifications at p. 11 of the Application states that such air flow controller "decreases the temperature gradient around the hot object", indicating *that cool air at a sufficient pressure to meet the desired flow rate would be introduced.* (emphasis added).

Applicant disagrees, however, with the inference taken by the Office (shown in italics above). "Decreasing temperature gradient" does not imply "decreasing temperature" for example, by using chilled air. A temperature gradient is the rate of temperature change in a given space. Decreasing the temperature gradient indicates making the temperature in the space uniform. Making the temperature uniform in a space may be achieved, in the case of a hot object, by heating up the space, as stated in the patent application that "air flow 43 will be at a pre-selected temperature" (Page 11 of the present specification, lines 16 and 17). Claim 14 has been amended to make this aspect express.

In contrast, blowing "cool air" as contended by the Office can have an adverse effect on the hot object. In many applications, the cooling rate determines the microstructure of the final product. The cooling rate is a mechanism to control the final product property (a.k.a. heat treating). Claim 14, as amended, now recites that the air is "at a preselected temperature to reduce a temperature gradient . . .." This is not taught by Fishman.

The Office action further states that "Fishman suggests that when imaging an object at sufficiently high temperatures that optical distortion occurs, one would introduce chilled air passing the object at an appropriate flow rate to control such effects." The Office infers the foregoing from the disclosure of Fishman, and buttresses its inference with the statement that in Fishman "no other reasons are suggested." Applicant respectfully disagrees.

Fishman expressly discloses that chilled or inert air is provided specifically for removing "fumes and dust" instead of reducing optical distortion by reducing a temperature gradient. The Office's attention is directed to column 4, lines 61-66 of Fishman:

> If desired, chilled air or inert gas, ... may be introduced into tube 70 through inlet 76 to generate a positive pressure in tube 70 to prevent **FUMES** and **DUST** from entering tube 70 and interfering with the vision of camera 66. (emphasis added).

Applicant respectfully submits that in Fishman, to the extent that the introduced airflow is "chilled", it is done so as to not melt or otherwise damage the camera due to hot air (*i.e.*, the camera is directly intermediate the airflow inlet and the molten metal in the mold). To the extent the airflow is "inert" it is done so to avoid chemical interaction with the surface

of the molten metal. Fishman simply does not disclose introducing air "at a preselected temperature to reduce a temperature gradient to remove air density distortion" as now positively claim. Therefore, for at least these reasons, it is respectfully submit that claim 14 defines novel and nonobvious subject matter over *Milnes* and *Fishman* and should be allowed.

VIII. NEW CLAIMS

Claims 20-22 have been added to more fully and adequately capture the scope of invention to which Applicant is entitled. Claim 20 recites an area imaging feature of the invention. *Milnes* at most must disclose a line, not an area. Nor would it be obvious to modify *Milnes* from a line source to an area imaging, since that would destroy a feature of the *Milnes* invention, namely, the visual simplicity of observing with the naked eye "lines" to assess workpiece depth and surface and contours.

Claim 21 is Claim 14 rewritten in independent form, but without the new limitation added by amendment in Claim 1. Claim 22 recites further novel and non-obvious subject matter.

IX. CONCLUSION

For at least the above-cited reasons, all claims pending in this Application are now believed to be allowable. Applicant respectfully requests that any questions or concerns be directed to Applicant's undersigned attorney.

Respectfully submitted,

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